MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2022/2023

PSM0325 – INTRODUCTION TO PROBABILITY AND STATISTICS

(Foundation in Information Technology)

5 JULY 2023
9.00 a.m. – 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of **THREE** pages excluding the cover page and the Appendix.

2. Answer **ALL FIVE** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please write all your answers in the Answer Booklet provided. All necessary working steps **MUST** be shown.

4. **Statistical table** and **Key Formulas** are provided.

Question 1 (10 marks)

The following data gives the heights of a sample of 70 teenagers who enrolled in an outdoor event.

Height	Number of Children
141 – 150	4
151 – 160	19
161 – 170	33
171 – 180	12
181 – 190	2

a. Find the cumulative frequency, class boundaries and class midpoints for each class. [3 marks]

b. Calculate the mean of height of the teenagers. [2 marks]

c. By using ogive, find the median. [5 marks]

Question 2 (10 marks)

a. A group of executive and non-executive staff are categorized according to the number of years they have worked in a company. The data obtained is summarized as follows:

Level	Working Years		
	Less than 5 years	5 to 10 years	More than 10 years
Executive	10	23	35
Non-Executive	31	16	8

If a staff is selected at random, what is the probability of selecting

i. a staff who have worked for more than 10 years? [1.5 marks]

ii. a staff who have worked for less than 5 years, given that the staff is a non-executive staff? [1.5 marks]

Continued ...

b. The probability density function of a random variable X is given below:

$$f(x)=\begin{cases}k(3x-2); & 1<x<4\\ 0; & otherwise\end{cases}$$

i. Show that the value of $k=\frac{2}{33}$. [3 marks]

ii. Calculate the mean of X. [4 marks]

Question 3 (10 marks)

a. In a certain document, the average number of markings found per page is 10. If a page is randomly selected, find the probability that there will be

i. at least 5 markings on that page. [2 marks]

ii. 8 to 12 markings on that page. [2 marks]

b. The length of a rod is normally distributed with a mean of 150 cm and a standard deviation of 15 cm. If a rod is selected at random, find the probability that the length of the rod

i. is more than 160 cm. [2 marks]

ii. is between 135 and 170 cm. [4 marks]

Question 4 (10 marks)

a. The test scores of all the 6 students in a class are given:

35 42 58 42 47 39

List all the possible samples of size five from this data and construct a sampling distribution of the sample mean. [5 marks]

b. The time taken by a company to build a certain product has a mean of 60 days with a standard deviation of 18 days. Find the probability that the mean time taken to build 100 units of this product will be:

i. more than 65 days. [2 marks]

ii. between 58 and 64 days. [3 marks]

Continued ...

Question 5 (10 marks)

A lecturer recorded the time taken by his students to complete an assignment, and found that the mean time taken is 60 minutes, with a standard deviation of 10 minutes. The lecturer claims that with his last group of students, the time taken to complete the assignment has increased. To test the lecturer's claim, a sample of 50 students is selected and the time they take to complete the assignment is recorded. The mean time taken by the 50 students is found to be 65 minutes.

a. Construct a 95% confidence interval for the mean time taken by all the students. [3 marks]

b. At the 0.05 level of significance, is there evidence to show that the time taken by the students to complete the assignment has increased? [7 marks]

End of Paper

Appendix: Keys Formulas

1. Ungrouped data: $\bar{x} = \frac{\sum x}{n} \quad s^2 = \frac{1}{n-1}\left(\sum x^2 - \frac{\left(\sum x\right)^2}{n}\right)$

2. Grouped data: $\bar{x} = \frac{\sum fm}{\sum f} \quad s^2 = \frac{1}{\sum f - 1}\left(\sum m^2 f - \frac{\left(\sum fm\right)^2}{\sum f}\right)$

3. Grouped data:

$$\text{Median} = L + \left[\frac{\left(\frac{\sum f}{2}\right) - F}{f_m}\right] w$$

4. Grouped data:

$$\text{Mode} = L + \left[\frac{f_m - f_b}{(f_m - f_b) + (f_m - f_a)}\right] w$$

5. Additive Rule: $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
6. Complement Rule: $P(A') = 1 - P(A)$
7. Conditional Probability: $P(A \mid B) = \frac{P(A \cap B)}{P(B)}$
8. Binomial Formula: $P(X = x) = \binom{n}{x} p^x q^{n-x}; \quad \mu = np; \quad \sigma^2 = npq$
9. Poisson Formula: $P(X = x) = \frac{(\lambda t)^x e^{-\lambda t}}{x!}; \quad \mu = \sigma^2 = \lambda t$
10. Discrete Random Variables: $E(X) = \sum xp(x) \qquad E(X^2) = \sum x^2 p(x)$
11. Continuous Random Variable: $E(X) = \int_{-\infty}^{\infty} xf(x)dx \qquad E(X^2) = \int_{-\infty}^{\infty} x^2 f(x)dx$
12. Variance of Random Variable: $V(X) = E(X^2) - [E(X)]^2$; Standard deviation = $\sqrt{V(X)}$
13. Normal Distribution: Z-score: $z = \frac{x-\mu}{\sigma}$
14. Sampling Distribution: Z-score: $z = \frac{x-\mu_{\bar{x}}}{\sigma_{\bar{x}}}$; where $\mu_{\bar{x}} = \mu; \ \sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$
15. Confidence Interval: $C.I. = \bar{x} \pm z\frac{\sigma}{\sqrt{n}}$ or $\bar{x} \pm z\frac{s}{\sqrt{n}}$
16. Test statistic: $z^* = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}}$ *or* $z^* = \frac{\bar{x} - \mu}{s/\sqrt{n}}$